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DERWENT-WEEK: 197832

TITLE: Preheating plastics **sheet** to be thermo-formed - by jetting hot steam and/or **gas** onto it from both sides

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BASIC-ABSTRACT:

A plastics **sheet to be thermoformed** is preheated by jetting hot steam and/or **gas onto the sheet** from both sides. These may in addition be conventional preheating by **liq.** or radiant heat.

Pref. a **sheet** is moved upwardly through a chamber between two sets of pipes. Each pipe is provided with nozzles which direct a jet of hot steam and/or **gas** downwardly onto the **sheet**. The exit opening of the chamber may be flooded with a constant **temp. gas** or vapour which is inert to the **sheet**.

A **uniform heating which cannot exceed the temp.** of the jet, which **temp.** is closely controllable, is achieved, leading to more **uniform** articles with a better surface finish.

TITLE-TERMS: PREHEAT PLASTICS **SHEET** THERMO FORMING JET HOT STEAM **GAS** SIDE

DERWENT-CLASS: A32

CPI-CODES: A11-A02A; A11-B08;

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(19)

(54) IMPROVEMENTS RELATING TO THE MANUFACTURE OF THIN WALLED PLASTICS ARTICLES BY THERMOFORMING

(71) We, PLASTONA (JOHN WADDINGTON) LIMITED, a British Company of Wakefield Road, Leeds, LS10 3TP, Yorkshire, do hereby declare this invention and the method by which it is to be performed, to be described in and by the following statement:—

This invention relates to the manufacture of thin walled plastics material articles which are formed from sheet plastics materials (which may be laminates).

Any suitable technique such as vacuum forming, pressure forming, plug assist or mechanical forming or any combination of such techniques may be used in the forming of the articles, but in all cases the sheet material is heated to effect a degree of softening of the material so that it can be formed and therefore the forming of the articles will be referred to simply and generally as "thermoforming".

Thermoforming is of course well known and is widely practised, and there are many thermoformed articles in every day use in many countries of the world, such articles including domestic hollow-ware and drinking cups.

Certain materials, and in particular polypropylene, polyethylene and expanded plastics sheet require to be thermoformed at very accurate temperatures in order to achieve high speed production and high quality products. Conventional methods of heating such as infra-red heaters do not provide sufficient accuracy of heating to achieve these desirable features even when the sheets being thermoformed are of uniform thickness which in commercial practice is not usually the case.

Furthermore, many types of plastics sheet wrinkle or sag when being heated which causes even further temperature variations in the heated sheet, when the heating to the thermoforming temperature is carried out by a radiation process.

The present invention seeks to provide a wide range of plastics sheets including polystyrene, A.B.S. acrylonitrile, nylon polyester, polyvinyl chloride, cellulose acetate, the so-called "filled" plastics sheets containing filler material of inorganic particulate form, and indeed any sheet which is capable of being thermoformed, and in which the aforesaid disadvantages are obviated or mitigated.

According to the present invention there is provided a method for the manufacture of thin walled plastics material articles, wherein the articles are thermoformed in a heated, continuous sheet of the plastics material and the sheet is heated by a heating process including jetting hot gas and/or steam from nozzle means directly onto both sides of the sheet.

Heating by jetting with gas and/or steam ensures that even heating of the sheet across and the sheet can at no point reach a temperature which is greater than that of the jetting medium, which temperature can be controlled accurately.

The sheet may travel upwards as it is being heated by said jetting. The jetting may be in a direction which is downwardly inclined. Heating by jetting may take place in a chamber through which the sheet may travel vertically upwards and the heated sheet may pass directly to a thermoforming machine or unit at which the articles are formed. The specific construction of the articles is of course immaterial to this invention, although we are particularly interested in the thermoforming of small domestic hollow-ware articles.

Where steam is used as the jetting medium, the downward inclination of the jetting as against the upwards movement of the sheet will tend to wipe away any condensation downwards away from the thermoforming machine, which is a desirable feature of the preferred arrangement. The sheet may travel through a duct in passing from the jetting region to

this duct be closed and flooded with a gas or vapour which does not effect the sheet chemically but the temperature of the gas or vapour in the duct is preferably kept constant and is controlled.

The temperature of the jetting medium and also that in the duct will preferably be therostatically controlled in order to ensure that the sheet reaches and does not locally deviate from a preselected temperature. The minimum length of time which the sheet must be jetted upon to reach the desired temperature will depend upon the dimensions of the sheet, but in any case this time can be adjusted to suit the material being heated. There is no maximum jetting time as the temperature of the sheet cannot get higher than the jetting medium and this temperature will be carefully controlled.

Articles, such as domestic hollow-ware, formed from polypropylene heated in this manner can be reliably produced in large quantities and taking large numbers on average they exhibit an excellent surface finish, toughness and clarity which are better than those characterising in conventionally formed polystyrene articles.

It is not necessary that the jetting should comprise the whole of the heating process of the sheet. Pre-heating such as heating by immersion in a liquid, radiant heating or the like may be employed.

The invention thus provides a simple method whereby plastics material webs can be heated evenly, enabling the effective use of plastics materials such as the polyolefins e.g. polypropylene, for thermoformed articles produced in large numbers; the cycle time can be made very short and in many cases a cheaper to produce yet superior article can be produced.

The invention also provides articles produced according to the method as aforesaid.

An embodiment of the invention will now be described, by way of example, with reference to the diagrammatic drawing accompanying the provisional specification, wherein:

Figure 1 shows a side elevation of a jetting chamber and a web of plastics material passing therethrough; and

Figure 2 shows the apparatus of Figure 1 in front, central sectional elevation.

Referring to the drawing, the apparatus shown comprises basically a relatively narrow sectioned box 10, defining internally a heating chamber 12. The box has its two largest sides 14, 16, disposed in vertical planes, and the top 18, and bottom 20, each is provided with a slot 18A, 20A. These slots 18A and 20A extend for almost the entire width of the chamber, as shown in Figure 2. The end wall 22 (Figure 2) is a plane wall, and the end wall 24 has a plurality of apertures through which extend heating medium feed pipes 26. As will be seen clearly in Figure 1, these pipes 26 are arranged in two parallel vertical planes inside the chamber. The planes containing the tubes 26 are spaced from but parallel to the side walls 14 and 16.

In the example shown, each bank of pipes contains six pipes and the pipes are horizontal, parallel and equally spaced vertically. Each of the pipes 26 is provided with nozzle means in the form of outlet apertures 26A, as best seen in Figure 2, and from these apertures heating medium issues in a manner illustrated generally at 28, in Figure 1 directly onto the sheet. It will be seen that the heating medium is directed in a downwardly and inwardly inclined manner onto the sheet 30 of thermoformable plastics material, such as a sheet of polypropylene which is continuous and travels in the direction indicated by arrow 32 in Figure 1, up through slot 20A centrally between the banks of feed pipes 26, and out through slot 18A directly to a thermoforming machine as desired.

In the example shown, the heating medium is steam, the temperature of which is carefully thermostatically controlled, in order to heat the sheet 30, to a preselected and controlled thermoforming temperature. This method ensures that the sheet is heated evenly.

As shown in Figure 2, the bank of pipes 26 is supplied from a single steam manifold 34, whilst used steam is drawn through slot 20A into a steam cheat 36, and out through outlet 38. Steam chest 36 will be provided with a suitable slot to enable the web 30 of thermoformable plastics material to pass up through the apparatus. In a modified arrangement, each pipe 26 will be provided with steam which is at a different temperature from the steam supplied to the other pipes 26. This may be desirable when it is required to heat the sheet gradually as it moves up between the banks of pipes. Furthermore, the number of pipes may be increased or decreased as desired, depending upon the thickness of the sheet being heated, the required speed of heating and the temperature to which the sheet is to be heated.

The box casing 14 may be provided with suitable insulation cladding, as desired, as there may be an outlet whereby condensation may be removed from the chamber 12.

By virtue of the downwardly inclined action of the jets 28 on the sheet 30, there will be exercised a jet wiping effect whereby any condensate which may collect on the sheet will be wiped downwardly off the sheet, so that the material which passes

out of slot 18A will be free of any residue of the jetting medium.

WHAT WE CLAIM IS:—

1. A method for the manufacture of thin walled plastics material articles, wherein the articles are thermoformed in a heated, continuous sheet of the plastics material and the sheet is heated by a heating process including jetting hot gas and/or steam from nozzle means directly, onto both sides of the sheet.

2. A method according to claim 1, wherein the sheet is in upwards disposition as it is being heated by said jetting.

3. A method according to Claim 2, wherein the sheet travels in an upwards direction as it is being heated.

4. A method according to Claim 2 or 3, wherein the jetting is in a downwardly inclined direction.

5. A method according to any preceding claim wherein the heating by jetting takes place in a chamber.

6. A method according to Claim 5, wherein the sheet extends vertically through the said chamber.

7. A method according to Claim 6, wherein the heating by jetting is effected by jets of heating fluid issuing from nozzle apertures in banks of pipes on each side of the sheet.

8. A method according to Claim 7, wherein, of each bank of pipes, the pipes are arranged vertically spaced, and the heating fluid issuing therefrom is progressively hotter the higher the pipe.

9. A method according to any preceding claim, wherein the jetting fluid is steam.

10. A method according to any preceding claim wherein the sheet in travelling from the jetting region to the thermoforming machine, passes through a duct, the interior of which is kept at a constant temperature.

11. A method for the manufacture of thin walled plastics materials articles, substantially as hereinbefore described.

12. Thin walled plastics material articles manufactured in accordance with the method of any preceding claim.

13. Apparatus for thermoforming thin walled plastics material articles from a continuous plastics material sheet, comprising sheet heating means defining a heating chamber through which the sheet can be caused to pass, nozzle means for jetting heating fluid directly onto both sides of the sheet when in said chamber, and a thermoforming machine arranged to receive the heated sheet coming from said heating means whilst still hot and to thermoform the articles therein.

14. Apparatus according to Claim 13, wherein the heating means is adapted so that in use, the web passes upwardly through the chamber, and said nozzle means are arranged to jet the heating fluid in a downwardly inclined direction onto the sheet.

15. Apparatus for thermoforming thin walled plastics material articles from a continuous plastics material sheet, substantially as hereinbefore described with reference to the drawing accompanying the Provisional Specification.

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1521037 PROVISIONAL SPECIFICATION
1 SHEET This drawing is a reproduction of the Original on a reduced scale

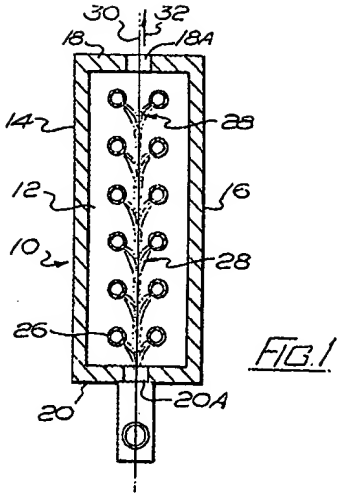

FIG.1

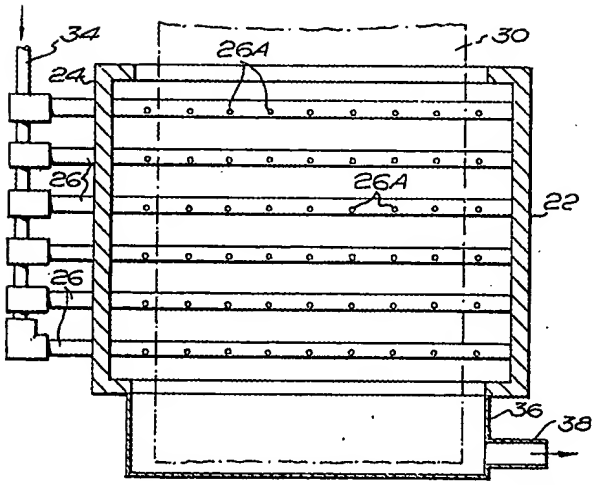

FIG.2